**3GPP TSG RAN#90e RP-20xxxx**

**e-Meeting, 7th – 11th December, 2020**

**Agenda item:** 9.1.1

**Source:** Nokia

**Title:** Moderator's summary for email discussion [90E][07][RedCap\_WI\_scoping] Initial round

**Document for:** Discussion/Decision

# Introduction

The documents considered as background to this discussion are listed in the references section at the end of this document. The deadline for comments in the initial round is 12:29 UTC on Tuesday 8th December.

# Initial Discussion

For the initial discussion round, we will focus on selected topics where there is the greatest need for convergence.

## Minimum number of supported Rx branches in FR1 TDD bands that currently support 4RX

There is currently strong support as well as strong opposition to allowing 1 Rx branch for this case. Form factor is the primary motivation cited by those in favour of 1 Rx branch, and there is clearly a strong feeling that there is a real market for such devices. On the other hand, strong concerns have been raised, citing the high coverage impact leading to a potentially unfeasible amount of specification work to be done as well as non-negligible network impact.

If devices with 1 Rx branch are to be supported, consensus would need to emerge on how this can be done in a way that addresses the concerns. Some possible compromises have already been mooted, including an upper frequency limit for 1 Rx, or higher antenna efficiency assumption for 1 Rx, for example.

In this section, companies are invited to propose ways forward. Please do not simply restate your preference for 1 Rx vs 2 Rx!

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| **Company** | **Proposed way forward** |
| T-Mobile USA | T-Mobile USA supports the proposed wording in RP-202701. As a way forward we would propose that TDD Bands that currently require 4Rx should require 2 Rx for RedCcap, and RedCap devices that can only support 1 Rx chain due to size or other constraints can use FDD bands. Operators deploying NR standalone need to be able to offer 5G enabled wearables. Without this change these devices are limited to LTE.  We share others’ concern that handheld devices should be required to meet the current RX antenna requirements. Enabling the ability to deny access to REDCAP devices adequately addresses this concern. |
| FUTUREWEI | As stated in our paper RP-202180, we have concerns on 1RX in these bands. Our biggest concerns are network impact and standardization impact. For a way forward, the network impact could be mitigated by including *now*, rather than postponing till after RAN2 study, the RAN2-led objectives on both RedCap UE types for identification/constraining and functionality for identification/restriction. In some cases the RAN2 decisions already say to resolve in the WI phase or wait for RAN1, in any case the objectives can be updated as needed after the next RAN meeting. For standardization impact, it is necessary to include *now* that there are no additional standardization impacts from including 1RX. Specifically, there are no PDCCH enhancements considered in RedCap. (Msg2/4 compensation should already be included in the WID for FR2, and exisiting techniques are sufficient for PDSCH.) The proposal on the GTW to not apply the 3dB penalty for 1RX may a a step also in the direction of making 1RX more acceptable. |
| Sierra Wireless | Sierra Wireless supports the current wording in RP-202701 as a way forward. Since the proposal supports 1 RX device for lower bands, use cases where devices are extremely size limited (e.g. wearables) can still be supported in a spectral efficient way. |
| CMCC | CMCC see it a compromise solution to mandate higher antenna efficiency for 1 Rx than that for 2Rx, which can guarantee 1 Rx and 2 Rx can achieve comparable coverage, and hence no special coverage recovery solution is needed. As to that it will scarify the dual layer transmsion in some sense, we have to admit that implementation reality and place some trust in our UE partners. |
| OPPO | For the coverage problem, it is clear that the case of potential problem is only in case of lower PSD (24dBm/MHz, which means very low for Macro Cell). For higher normal PSD, 1RX with all other possible loss will not results in coverage bottleneck in downlink.  Further, the concern of TDD coverage would be addressed by the access control of redcap UE.  Instead of complete disallow 1RX, which is only feasible for wearable, we should includes 1 RX. We can consider higher bandwidth as >4GHz, or as for higher antenna efficiency.  Addtionally, 1 RX or 2 RX can be used as differentiation of access control by NW side. |
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## Relaxed UE processing times (N1/N2)

On relaxed UE processing times, there seem to be a range of opinions and no evidence of consensus. Here, compromise proposals are invited, in case these could lead to an agreeable way forward.

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| **Company** | **Proposed way forward** |
| FUTUREWEI | No strong feeling here, if included it should be a second priority optional feature. |
| Sierra Wireless | Given the small cost savings and that the cost savings does not accumulate over bands, this feature should be consider later after other higher priority features are agreed. |
| CMCC | No, if redcap UE definitely require relaxed UE processing times, which may means all the existing gNB need to upgrade (different Rx number and layer number is not new to the network) if redcap UEs ared introduced to network even some of those gNB have already provided quite good coverage. Without relaxation, operators at least not necessarily need to upgrade the initial access procedue for some gNBs. |
| OPPO | We suggest to support it with simple scope, e.g. define doubled Ns. |
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## Reduced PDCCH monitoring

There appears to be strong support for reduced PDCCH monitoring, with the main support being for “Scheme #1” (reduced maximum number of Blind Decoding (BD) per slot in connected mode).

It seems reasonable, therefore, to focus the discussion here on Scheme #1.

What is not clear, however, is what needs to be specified specifically in the RedCap WI, compared to what has already been specified in R16 power saving and what is being addressed in the R17 power saving WI. If RedCap-specific aspects are seen useful, companies are invited to explain here the details of what should be included in the RedCap WID and why it needs to be specific to RedCap.

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| **Company** | **RedCap-specific aspects of reduced PDCCH monitoring Scheme #1** |
| T-Mobile USA | Best place to address this issue is in the power saving WID. |
| FUTUREWEI | No strong feeling here, if included we prefer to focus on scheme #1 targeting no increase of the blocking rate. If this can be done without new specification impact then it will be a quick objective in the WG. |
| Sierra Wireless | This feature should be added to the power saving WID, assuming it fits within TU budget. There is no clear reason why this would be done in the RedCAP Wi and conducting power saving work within two work items is not efficient. |
| CMCC | More belong to power saving WID. |
| OPPO | We suggest to include the scheme with directly reduced blind decodes by half for RedCap UE. This will have very minor spec impact and achieve simplication of implementation. |
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## Early identification of RedCap UEs

Early identification of RedCap UEs is clearly seen as being strongly necessary. If there are specific proposals that could be agreeable to refine the scope of the WI objective for this, companies are invited to propose them here:

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| **Company** | **Potentially agreeable proposals to refine the scope of the WI objective for identification of RedCap UEs** |
| T-Mobile USA | The use of UE categories or any horse of a different colour would not be supported by T-Mobile USA in achieving this objective. |
| FUTUREWEI | We support “Early identification in Msg 1 is supported for at least some RedCap UEs” as a subbullet of “Specify functionality that will allow RedCap UEs to be explicitly identifiable to networks and network operators and allow operators to restrict their access.”  Note that the language intentionally does not say “RedCap UE types” as type discussion is ongoing in RAN1 and RAN2. If needed we can add a note that supporting early identification is not the same as introducing UE categories (we are not in favor of introducing UE categories in NR). |
| Sierra Wireless | There doesn’t need to be a specific objective on early identification. The WGs can decide if early ID is needed (will depend on features) and the best solution (msg1,msg3 or msg5). Plenary should not recommend a solution.  There is also no need to specify UE categories. We only need to define optional UE capabilities for the cost reduction techniques but this doesn’t need to be capture in WID – its business as usual. So no need for this bullet: “o Specify definition of RedCap UE type(s) including set(s) of L1 capabilities at least for RedCap UE identification and for constraining those UEs to the intended use cases.”  There is however, a need for this bullet:” o Specify functionality that will allow RedCap UEs to be explicitly identifiable to networks and network operators and allow operators to restrict their access.” If there is a need to restrict access before UE capabilies (Msg5) are exchanged, this would be good to specify here. |
| CMCC | Earlier identification should be decoupled with special UE capability, decoupled with reacap UE, at least it should not be mandatory requirements for the network to serve the redcap UE. |
| OPPO | We see both early identification by Msg 1 and 3 for some RedCap UEs could be the sub-bullet. |
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## Other points

There seems to be strong support for HD-FDD type A.

**Moderator’s proposal: HD-FDD type A is supported**

Coverage compensation will be further discussed after the conclusion of the number of UE Rx branches in section 2.1. Work on coverage recovery aspects could be deferred until after RAN#91e in order to be able to assess the reusability of the work done in the Coverage Enhancement WI.

For the supported bandwidth after initial access, very heavy discussion has already taken place in RAN1, and, from the RAN plenary tdocs, there seems no evidence of a different consensus now emerging compared to what is in the current draft WID [18].

In other topics, there does not seem to be evidence of majority support going in a different direction from what is in the current draft WID [18].

If there are important comments on the above or other points, companies may state them here.

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| **Company** | **Other important comments** |
| FUTUREWEI | We do not think half-duplex should be directly proposed as agreed without further discussion. Issues include: (1) not applicable to TDD bands, (2) RAN1 could not agree on whether the existing specifications could be reused or not. Similar to processing time reduction, if in the end it is included it should be a second priority optional feature.  Coverage compensation is best not to leave open. RedCap should include what is needed for RedCap in RedCap. Whether and how RedCap UEs use Rel-17 CovEnh features (and existing Rel-15/16 features that help coverage) is discussed later along with RedCap UE capabilities.  The current draft WID mentions 3dB for PUSCH/Msg 3, which does not include the new proposal from GTW to not include this factor for 1RX. The labguage in the draft would need tobe revised as it prioritizes the CE WI over existing techniques from Rel-15/16.  The draft needs to include PDSCH/Msg2/Msg4 where the SI shows that some coverage enhancement is needed for FR2 for the 100MHz 1RX case for 23dBm UEs. (Note1: this is *not* dependent on the 4RX to 1RX question in section 2.1. Note2: PDSCH/Msg2/Msg4 are not included in the draft CE WID.)  The current WID is prefered for bandwidth after initial access to avoid repeated discussions. |
| Sierra Wireless | Agreed that HD-FDD type A shall be supported but scope needs to be considered.  Having two Wis (RedCap & CovEnh) doing coverage enhancement is extremely inefficient – we saw this in the SI phase. The RedCAP SI did not agree on techniques for coverage enhance only targets so at best this would be another study of techniques to meet a target. Thus: all coverage related work should be done in CovEnh WI including Msg3 coverage enhancement. Given 1RX in high TDD bands is not support, there should be no need to do coverage enhancement for FR1 DL channels. The enhancements for FR2 DL should also be include in the CovEnh WI.  We see the option of increasing bandwidth after initial access beyond 20MHz as low priority. |
| CMCC | Not urgent |
| OPPO | RAN1 conclude to make FR1 other than 20MHz as FFS:   * + Whether an FR1 RedCap UE can optionally support a maximum bandwidth larger than 20 MHz after initial access   We can forward the discussion in WI phase.  Type A HF can be support. |
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# Company contact details

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# References

1. RP 202180 Scoping for R17 RedCap WI Futurewei
2. RP 202268 Scope of Rel-17 WI on support of reduced capability NR devices Huawei, HiSilicon
3. RP 202303 Discussion on WI scope of RedCap device OPPO
4. RP 202323 Views on the scope of RedCap WID CMCC
5. RP 202346 Motivation for Reduced Capability NR devices WID Sierra Wireless, S.A.
6. RP 202353 Views on Reduced Capability NR device WI Intel Corporation
7. RP 202355 On overlapping objectives across Rel-17 WIs Intel Corporation
8. RP 202525 Views on RedCap WID scope NTT DOCOMO, INC.
9. RP 202531 On the scope of Rel-17 reduced capability NR devices Samsung
10. RP 202550 Views on Reduced Capability NR devices Xiaomi Technology
11. RP 202560 On the open issues for support of Redcap NR devices Apple Inc.
12. RP 202637 Views on WID scope for Rel-17 RedCap vivo
13. RP 202642 Performance issues with supporting 2Rx for wearables in FR1 vivo
14. RP 202667 On WI scope of support of reduced capability NR devices ZTE, Sanechips
15. RP 202693 Discussion on WI scope for RedCap NR devices MediaTek Inc.
16. RP 202712 Views on support of reduced capability NR devices in Rel-17 CATT
17. RP 202696 Scope of RedCap WI Nokia, Nokia Shanghai Bell
18. RP 202701 New WID on support of reduced capability NR devices Ericsson
19. RP 202702 Motivation for New WI on support of reduced capability NR devices Ericsson
20. RP 202746 Views on scope of NR RedCap WI Qualcomm Incorporated